



## BIOMASS FEEDSTOCK NATIONAL USER FACILITY

*Solving today's feedstock challenges –  
engaging industry in solutions for tomorrow*

### **Feedstock Process Demonstration Unit**

*Produce feedstock – any feedstock,  
and specification, any scale*

*Develop and test preprocessing  
unit operations*

*Develop and test fully integrated,  
fully instrumented, full-scale  
preprocessing systems*

### **Biomass Analytical Library**

*Characterize biomass physical and  
chemical properties*

*Access feedstock properties database,  
nearly 70,000 samples*

*Analyze and model feedstock supply  
and logistics designs*



U.S. DEPARTMENT OF  
**ENERGY**



Idaho National Laboratory





## Feedstock Process Demonstration Unit

**Feedstock development**  
*herbaceous and woody resources, on-specification for all conversion platforms*

**Process development**  
*size reduction, separation/fractionation, thermal treatment, chemical treatment, densification*

**System-level feedstock solutions**  
*identify preprocessing "bottle necks" and improvement opportunities*

## Biomass Feedstock National User Facility at Idaho National Laboratory (INL)

**B**ioenergy research at the Biomass Feedstock National User Facility (BFNUF) is focused on reducing biomass feedstock variability to meet the needs of producers of biofuels, biopower, and other bioproducts. Facilities include pilot- and bench-scale preprocessing units for biomass drying, size and ash reduction, blending, and densification—and laboratories for physical and chemical analyses of biomass and engineered biomass feedstocks.

### Energy Systems Laboratory Access

The Biomass Feedstock Process Demonstration Unit (PDU) is located in a 27,000 square-foot high-bay at INL's Energy Systems Laboratory. Most projects involve sourcing biomass, preprocessing, and shipping of the preprocessed feedstocks to project participants and customers.

Other supporting capabilities are available at INL to enhance the user facility model. The Feedstock PDU is operated in concert with the Biomass Analytical Library—a national archive of biomass samples and information about each sample's source and processing history.

Biomass physical and chemical characterization data from samples at various stages throughout feedstock development is also incorporated in the library and linked to the physical samples. The Feedstock PDU, analytical laboratories, and associated sample library and physical

properties database help inform preprocessing operations to achieve biorefinery feedstock specifications and aid in mapping biomass feedstocks to conversion processes.

### Field Deployment

The Feedstock PDU was designed and constructed to be both reconfigurable and modular so it can be readily deployed at various sites. The modularity of the system facilitates insertion of alternative equipment or processes—in place of or in addition to any module—allowing advanced energy and efficiency studies. Most components are skid-mounted, installed in cargo containers, or can be collapsed and disassembled so they can be transported in compliance with state highway regulations. Deployment requirements for field operations of the Feedstock PDU are dependent on the modules requested and the proposed configuration customers need.

## Bench-Scale to Pilot-Scale Production

Today's biomass conversion processes require specific feedstock specifications that differ considerably among the various conversion pathways:

- Biochemical conversion pathways generally prefer herbaceous or hardwood biomass milled to intermediate mean particle sizes typically ranging from 6-50 mm.
- Pyrolysis requires a finely milled feedstock, typically less than 2 mm.
- Gasification can have a wide range of particle size specifications depending on the specific gasification technology.
- Combustion via co-firing with coal favors woody biomass that has been chipped and torrefied followed by fine-milling to produce a fine, coal-like feedstock.

In each case, tight tolerances on the particle-size distribution and precise preprocessing conditions are required.

### Feedstock Development

The user facility provides access to a range of biomass resources and preprocessing capabilities to produce virtually any feedstock, any specification, at any scale. Feedstock examples are shown at right.



pine chips



thermal-treated pine chips



6 mm milled corn stover



2 mm milled corn stover

### Feedstock Examples

### Process Development

The Feedstock PDU capabilities are grouped into five categories, with a variety of equipment types and sizes available in each: size reduction, separation/fractionation, thermal treatment, chemical treatment, and densification.

### System-Level Solutions

A unique capability of the Feedstock PDU is to test and develop fully integrated and instrumented industrial-scale preprocessing systems. Continuous processing and data collection enables:

- Identification of preprocessing bottlenecks.
- Exploration of the interaction and synergies of preprocessing operations affecting feedstock specifications and conversion performance.
- Optimization of integrated preprocessing systems.



## Biomass Analytical Library

**Biomass Characterization**  
*understanding physical and chemical variability*

**Performance Evaluation**  
*informing preprocessing operations to achieve refinery specification*

**Feedstock Logistics**  
*designing cost-effective, environmentally-sustainable supply systems*

**Database**  
*Nearly 70,000 samples catalogued, ready for industry use*





# Biomass Conference and Expo

## Visit INL Exhibit – Booth 1024

**Kevin Kenney** directs the activities of the Biomass Feedstock National User Facility (BFNUF) and leads the business development activities for INL's biofuels platform, focusing on biomass characterization, logistics, and preprocessing. Kevin has worked extensively with high-speed imaging, sensing and autonomous control in various industrial applications ranging from automotive manufacturing to agricultural machinery operations.

*He is participating in Track 4's Advanced Biofuels and Biobased Chemicals panel, March 25, 3:30-5 p.m.*

**Blended Biomass Feedstock Approach for Biofuel Production:** Kevin will address the impact of biomass variability, its challenges to achieving specifications and pathways for biofuel conversion. This will include a costs analysis as a means of valuating feedstock quality, techniques for specification enforcement, and biomass blending strategies that address cost and quality challenges for more effective operations with these least-cost approaches for biorefiners.



As INL's manager for energy systems development and testing, **Richard Boardman**, Ph.D., is responsible for the use of scientific computational tools and testing facilities supporting investigation of fossil-renewable-nuclear hybrid energy systems. He is an expert in coal and biomass combustion and gasification, synthetic fuels process modeling, gas technology, and atmospheric environmental chemistry. He also leads the National Science Foundation Center of Excellence in Combustion Research and Engineering.

*He is participating in Track 2's Biomass Power and Thermal panel, March 25, 1:30-3:00 p.m.*

**Logistics, Costs and GHG Impact of Utility-Scale Cofiring with 20%:** Richard will discuss technical and economic assessments of near-term co-firing up to 20 percent biomass at coal-fired electrical power plants. After explaining a combustion model for the power plants that was used to predict the impact on boiler efficiency and plant emissions, he will share the assessments derived from the research about the logistics, costs and environmental impact.



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